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Post-war Misfits

On August 1, 1914, a 15-year-old boy hurriedly left Germany for England with his school satchel as his only luggage. During 1919, this boy, by now 6 ft. tall and a qualified engineer, received from Germany his box of belongings. It was amusing to reconstruct his environment in pre-war days by the Eton collars, the little football boots, the collection of "bloods," the Latin and Greek primers, yet nothing was of the slightest use to him in his present condition. Our correspondent who specialises on keeping us up to date on the impact of legislation on matters industrial, points out elsewhere in this issue, that in the second post-war period, there is an obligation to revive all the trade union customs, employment contracts and conditions and the like in vogue in 1939, unless changed by mutual agreement. We suggest that many of these agreements will strongly resemble that box of schoolboy belongings. The pre-war caps will no longer fit, and reliance can be placed on those charged with the renegotiation of employment agreements to use these old rules and regulations as an agenda for the production of something better. Anything designed to limit production must be exorcised. There must be no more burning of "excess" coffee, or the putting of a foot through a perfectly good mould because it is in excess of trade union regulation daily production.

The Governments of the world have promised work for all, and to implement this they will require the complete elimination of all devices and practices designed to limit production. The duty of the trades unions will be not so much to watch their own employers as those of other countries to ensure that International Labour Office Regulations are being honoured.

A pair of pre-war trousers that no longer fits the post-war conditions is the Patent situation. It is common knowledge in technical circles, that in certain spheres and because of the financial set up, it is a waste of time and money to file a Patent application, whilst in others, providing one interlards one's claims with a sufficient number of "I am aware of this and that," a Patent will be granted, and nobody will object to the appearance of some modified piece of machinery entering the market if it is well made and functions efficiently. The truth is that the existing law sometimes operates quite well, but because of the enormous field to be covered, ranging, as it does, from chemical processes, through medical supplies, electrical gadgets, mining machinery to domestic appliances, it fails in many activities to be equitable. General experience shows that the law is better suited for the Patenting of mechanical contrivances than processes. Patenting the latter is often made difficult because our inventive grandfathers were allowed to "cover" ideas, which because the industrial sciences were then insufficiently developed they could not operate. For instance, the centrifugal system of casting metals was invented long before the introduction of the requisite high-speed motive power and adequate mechanical bearings. Two sets of Patent regulations seem to be required to cater for the essential differences existing between the purely mechanical contrivance and the industrial process.

There are quite a number of other pre-war conditions which, when peace comes, will resemble that schoolboy's box of belongings, and, like their owner, industry must be prepared to forget their existence and build up from wartime structures. Though these are a mixture of good and bad, they form as suitable a basis for reconstruction as do those which existed in 1939. Wartime has been a period of hard work and high industrial production, and these will be the dominant features for a number of years.

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FORTHCOMING EVENTS

FEBRUARY 9.

Manchester Association of Engineers:—"Batch Production and Its Effect on Choice of Manufacturing Plant," by T. P. N. Burness, M.I.P.E. At the Engineers' Club, Albert Square, Manchester, at 6.30 p.m.

FEBRUARY 10.

Royal Institute of Chemistry (South Yorkshire Section):—"Development and Industrial Application of Wetting Agents," by A. V. Billingham, B.Sc. At the Department of Applied Science, St. George's Square, Sheffield, 1, at 2.30 p.m.

FEBRUARY 13.

Sheffield Metallurgical Association:—"Any Questions?" At the Sheffield Metallurgical Club, 198, West Street, Sheffield, 1, at 6.30 p.m.

Institution of Chemical Engineers:—Joint meeting with the Chemical Engineering Group of the Society of Chemical Industry. At the Geological Society, Burlington House, Piccadilly, London, W.1, at 2 p.m. "Ammonia Synthesis From Coke-Oven Gas," by J. Watson Napier, B.Sc., A.M.I.Mech.E., M.I.Chem.E.

FEBRUARY 19.

Sheffield Society of Engineers and Metallurgists:—"The Manufacture of Seamless Steel Tubes," by Dr. J. W. Jenkin (Tube Investments, Limited). At the Royal Victoria Station Hotel, Sheffield, 1, at 6 p.m.

FEBRUARY 23.

Manchester Association of Engineers:—"Reclaiming and Hardening of Engineering Components by Electrodeposition," by H. Merryweather. At the Engineers' Club, Albert Square, Manchester, at 6.30 p.m.

Keighley Association of Engineers:—"Resistance Welding," by J. Berry, M.Inst.W. At Devonshire Buildings, Devonshire Street, Keighley, at 7.30 p.m.

Institute of British Foundrymen

FEBRUARY 10.

Scottish Branch:—"Some Aspects of Light Alloy Foundry Practice," by M. R. Hinchcliffe. At the Royal Technical College, George Street, Glasgow, at 3 p.m.

West Riding of Yorkshire Branch:—"Aluminium Bronze Alloys: Their Foundry Use and Characteristics," by N. C. Ashton. At the Technical College, Bradford, at 6.30 p.m.

FEBRUARY 17.

Bristol Branch:—"A Study in Moulding and Casting Technique for Small Steel Castings," by E. G. Kelly, O.B.E. At the Grand Hotel, Broad Street, Bristol, at 3 p.m.

Lincoln Section:—"Moulding Sands and Gases in Relation to Casting Defects," by G. W. Nicholls. At the Technical College, Lincoln, at 3 p.m.

FEBRUARY 24.

Birmingham Branch:—"Costs in a Jobbing Foundry," by H. E. E. Holladay, B.Sc. At the James Watt Institute, Great Charles Street, Birmingham, at 2.30 p.m.

East Midlands Branch:—"Some Thoughts on Foundry Management," by J. Roxburgh. At Loughborough College, at 6 p.m.

FEBRUARY 26.

Sheffield Branch:—"The Study of Liquid Metal Temperature and Solidification Range as a Foundry Control by Means of a Thermocouple," by R. C. Tucker, M.A. At the Royal Victoria Hotel, Sheffield, at 7 p.m.

FEBRUARY 28.

London Branch:—"Inoculated Irons," by A. E. McRae Smith, M.A. At the Charing Cross Hotel, London, W.C.2, at 7.30 p.m.

MARCH 3.

Bristol and West of England Branch:—"Plaster and Plastic Patternmaking and Low Melting Point Metals," by H. Plucknett. At the Imperial Hotel, Exeter, at 3 p.m.

BOOK REVIEW

Cast Metals Handbook, 3rd Edition, 1944. Published by American Foundrymen's Association, 222, West Adams Street, Chicago, 6, Ill., U.S.A. Price $6.00.

The 1944 edition of the A.F.A. Cast Metals Handbook represents a most extensive revision from the previous edition (1940). It deals exclusively with the engineering properties of cast metals, and has been prepared especially for use by those who design metal parts and who specify or purchase case metals for industrial products. The book includes considerable information of value to designers of castings, showing numerous examples of specific structures where redesigning has made possible a greatly improved cast product. Included are recommendations to buyers of castings that should answer many problems of the manufacturing purchasing agent. A section also is devoted to the significance of strength and ductility tests of metals, covering such tests as resistance to fracture, creep strength, hardness, static and dynamic ductility, corrosion fatigue, wear, etc.

Separate and extensive sections deal with steel, malleable iron, cast iron, and the non-ferrous alloys, all technical data included having been brought up to date in the light of cast metals developments made since publication of the previous edition. The book is intended for long-range use rather than simply to cover specifications made necessary by wartime shortages of and restrictions on metals. However, conforming specifications (A.S.T.M., Federal, Navy, S.A.E., A.M.S. and Bureau of Ships) are shown for both ferrous and non-ferrous products.

The technical data given were prepared and approved by committees of the American Foundrymen's Association, composed of many outstanding authorities on cast metals and foundry practices. Extensive bibliographies are included for each of the various cast metals sections, with the many references to both American and foreign foundry practices adding to the value of the book for research purposes.

The new Cast Metals Handbook has long been recognised as a standard treatise on the engineering usefulness of all cast metals, and as such should be of interest and value to all mechanical, product and designing engineers.

The "Nickel Bulletin" for December last contains abstracts dealing with condenser tube alloy specifications, fatigue resistance of copper-base and nickel-base alloys, age-hardening copper-manganese-nickel alloys, tests for hardenability of steel and the fatigue properties of low alloy nickel-chromium-molybdenum steels. Copies of the "Bulletin" may be obtained, free of charge, from the Mond Nickel Company, Limited, Grosvenor House, Park Lane, London, W.1.

"Bradley's Magazine," the house organ of Bradley & Foster, Limited, of Darlaston, Staffs, in its January issue prints an original research on Martensitic cast-iron breaker bars, and also gives a description of a method for the determination of the modulus of elasticity of acid-resisting cast iron.

PRECISION CASTING BY THE LOST WAX PROCESS*

This important Paper outlines a modern development of an old process

By ADAM DUNLOP

It has always been the desire of the foundryman to be able to make castings of such dimensional accuracy and finish that little, if any, machining is required. With this end in view, considerable attention has been paid to the use of such moulding equipment as well-fitting boxes, well-designed moulding machines and accurate metal patterns, etc. Considerable work has also been done to improve the surface finish of castings by the study of moulding sands and mould dressings.

FIG. 1.—GATED AND INVESTED MODEL OF STATUETTE.

In the field of low melting point alloys, such alloys which can be used in die casting, accuracy and excellent surface finish can be attained. However, there still remains a wide field of alloys and components of such design which can only be produced by sand casting, and while considerable progress has been made along the lines indicated, such castings for many engineering purposes usually require some machining, the cost of which varies considerably, depending on the design and the alloy used.

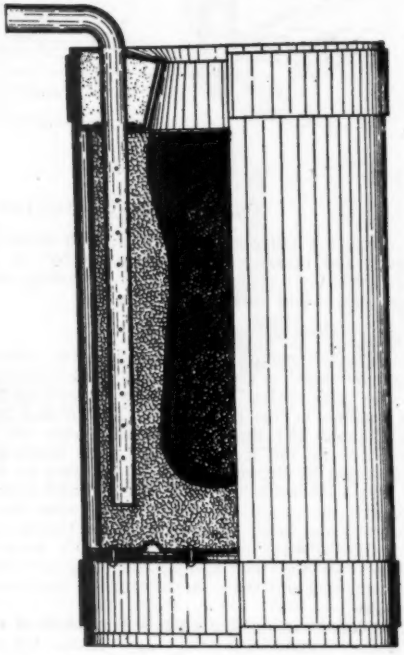

FIG. 2.—MOULD FITTED INTO FLEXIBLE RUBBER FLASK.

The purpose of this Paper is to outline a process by

* A Paper read before the Birmingham and West Midlands Branch of the Institute of British Foundrymen, Mr. G. R. Shotton presiding.

The Lost Wax Process

which castings in a wide range of alloys can be produced, of such dimensional accuracy and excellence of "as-cast" surface finish that little machining is required even for engineering components requiring a high degree of precision. By this process it is possible to produce small castings in steel, high nickel alloys, bronze and brass, etc., to within $\pm$ 0.002 in. per in. This precision casting process is a modern development of the old lost wax process.

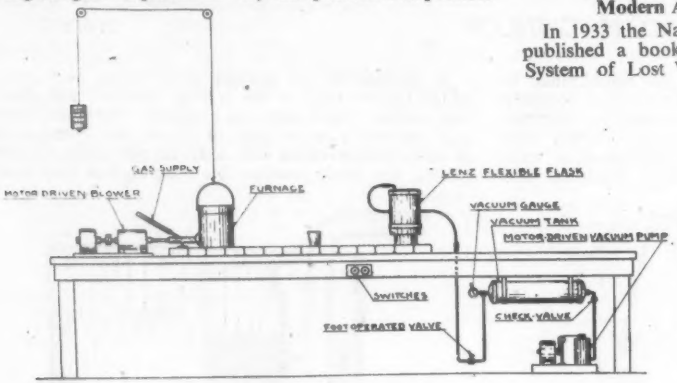

FIG. 3.—METAL CASTING INSTALLATION.

Historical

Before proceeding to describe the new technique, it might be useful to consider briefly the historical aspect of the "cire-perdue" or lost wax method of producing castings. This process was known and used by the Chinese and the Greeks many years before the Christian era, but it was lost for many centuries until re-invented by Benvenuto Cellini and used by him for his exquisite work in bronze, silver and gold. The fact that the process was lost or forgotten for many centuries has been suggested as the reason for the title "Lost Wax." However, the title most likely arises from the fact that in the original technique, when melting out the wax pattern, the wax was burnt and lost.

For cored castings the core is first made of suitable refractory material, such as crushed brick or thoroughly dried plaster. Upon this core an overlay of wax is formed on which the artist models the work. Metal rods pass from the core through the wax and project beyond. When the modelling is completed, the outer covering, which will form the mould, is applied to the wax in the form of a slurry of clay and plaster, which is sufficiently thin to find its way into every detail of the wax model. When this has dried, further coatings are applied, so that, when dry, a solid coating and a solid inner core are held together by the metal rods, with the work of art modelled in wax between. The wax is melted out by the application of heat and the molten metal poured in, and occupies every detail which the wax filled. When cold, the outer casing and inner core are removed, leaving the metal replica of the original wax model.

Modern Application to Artistic Casting

In 1933 the National Sculpture Society, New York, published a book entitled "The Alfred David Lentz System of Lost Wax Casting."[1] This book deals in detail with the procedure for making small bronze statuettes. It is briefly as follows. The model is made in wax. After fixing the necessary gates and vents in the form of wax rods, the wax pattern is coated with plaster of paris, followed by a second coat, consisting of equal parts of plaster and silica sand, with the addition of a small amount of asbestos

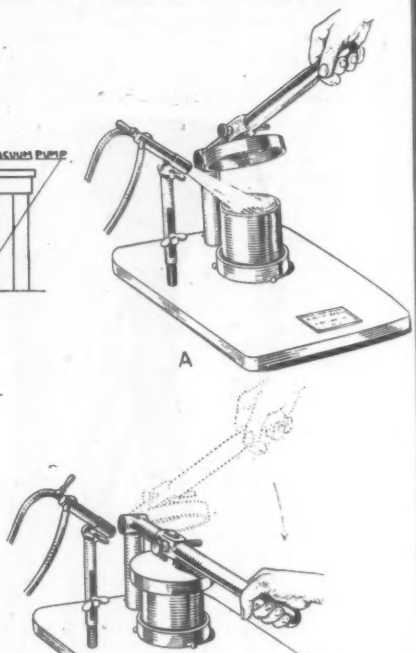

FIG. 5.—DENTAL PRESSURE CASTING EQUIPMENT. (COURTESY AMALGAMATED DENTAL CO.).

fibre to prevent cracking on drying. The operation is repeated many times until the model is covered to a depth of ½ in.

A metal cup-shaped casing, shown in Fig. 1, is pushed over the gate end of the mould and built up with the investment. To prevent confusion by the use of the word "investment," a term used by dental mechanics, it should be noted that in ordinary foundry practice this would be referred to as "moulding sand." This casing protects the model when it is placed in the "flexible flask" in a subsequent operation.

While the lost wax process is probably as old as casting, little commercial use has been made of the process until comparatively recently, excepting its use by dental mechanics in casting dental plates and, to a certain extent, in the production of jewellery.

Application to Dental Casting

In the production of dental plates, dimensional accuracy is of first importance. The methods used by the dental mechanic in attaining this accuracy are of interest and are worthy of brief consideration.

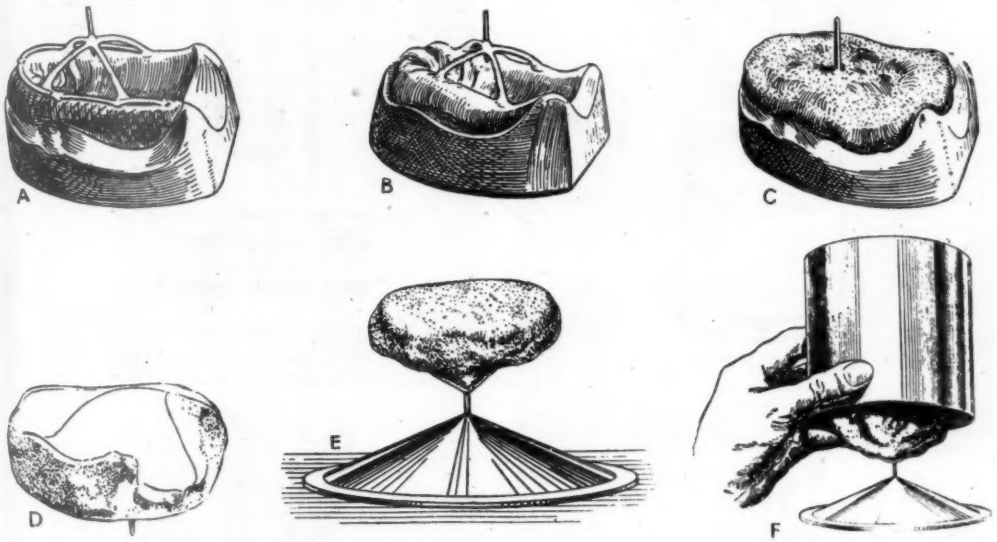

FIG. 4.—STEPS IN THE CONSTRUCTION OF A DENTAL PLATE. (COURTESY AMALGAMATED DENTAL CO.).

As before, the wax is removed by melting out, after which the mould is reinforced by binding spirally with soft iron wire, followed by a coating of asbestos cement, such as is used for steam-pipe covering. The mould is now baked by very gradually raising the temperature until all moisture is expelled. The next operation is illustrated in Fig. 2. The mould is fitted into a flexible rubber flask, which can be connected by the pipe to a vacuum system. Fig. 3 illustrates the method of casting. The apparatus consists of a crucible melting furnace and a vacuum pump and tank, complete with valves and piping. The alloy is melted and the vacuum pump run to obtain a reading of not less than 20 in. in the tank. The foot is placed on the valve control, the action of pouring the metal and stepping on the valve being simultaneous. On cooling, the mould is stripped and the casting cleaned.

When the wax pattern has been modelled from the oral impression, the wax sprues are attached (Fig. 4A). At this stage the shape of the wax model is preserved by contact with the plaster cast. From the centre of the sprue system a metal wire 0.06 in. in diameter is fitted. Fig. 4B shows the wax model coated with the investment material. In Fig. 4C the wax form is completely embedded, while in Fig. 4D the coated model has been removed from the plaster cast, and in Fig. 4E the covering has been completed and the invested wax form fixed in position on a metal cone, following which a cylinder is placed on the cone (Fig. 4F). The investing process is completed by filling the cylinder. When the mass is sufficiently set, the metal cone is withdrawn. The metal sprue pin is heated in the Bunsen flame and removed. The mould is slowly heated to remove moisture and melt out the wax, fol-

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lowing which the temperature is gradually increased until a red heat is attained.

The required amount of alloy is placed in the conical depression in the top of the mould and melted in a blowpipe flame. The molecular cohesion of the alloy is such that none leaks down the sprue which leads from the bottom of the cone. The molten alloy is forced into the heated mould cavity by the application of either steam or air pressure. Fig. 5A illustrates the apparatus used. When steam is employed as the pressure medium, this can be conveniently obtained by fixing an asbestos disc which has been saturated with water to the lid of the press prior to closing, steam being generated by contact with the hot cylinder. Fig. 5B shows the apparatus in the casting position. It is estimated that, when the above method is used, a steam pressure of 10 to 14 lbs. is generated.

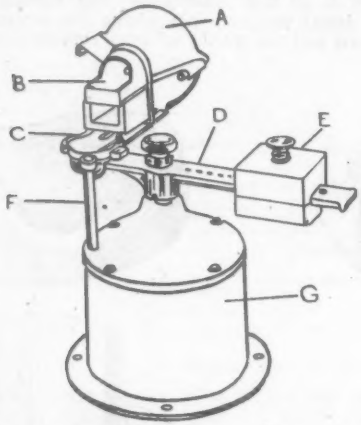

FIG. 6.—CENTRIFUGAL CASTING MACHINE.

A—Mould. B—Crucible. C—Secondary arm pivoted to main arm D. E—Counterbalance weight. F—Catch. G—Base containing steel spring.

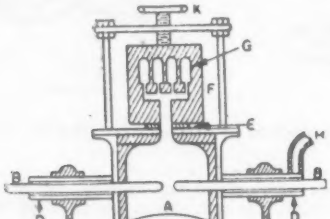

FIG. 7.—ELECTRIC ARC FURNACE PRESSURE CASTING UNIT.

A—Arc Furnace. B—Electrodes. C—Supports. D—Trunnions. E—Gaskets. F—Mould. G—Mould Cavities. H—Pneumatic Pressure Pipe. K—Mould Clamp.

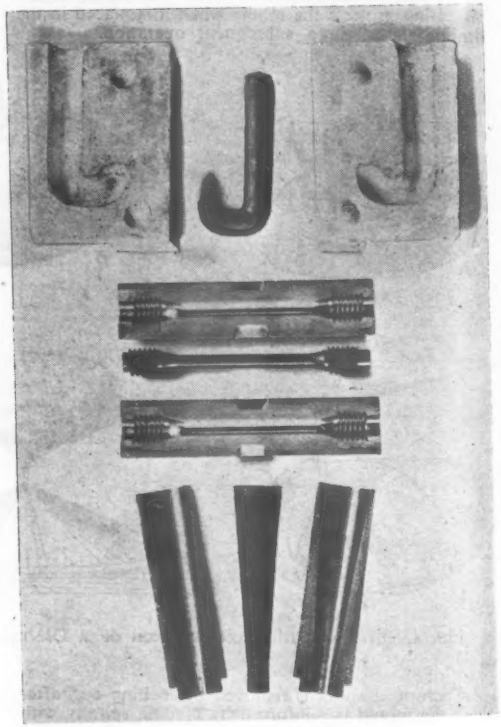

FIG. 8.—WAX TEST-PIECE PATTERN AND MOULD, TOGETHER WITH WAX FEEDERS AND MOULDS.

When air is employed as the pressure medium, a pipe from a compressed air supply is connected to the lid of the press, on closing which a valve is automatically opened and air at 20 to 25 lbs. per sq. in. admitted. In another type of casting machine the bottom of the mould is coupled to a vacuum system and the alloy sucked into the mould cavity.

Centrifugal casting machines are also employed, of the form illustrated in Fig. 6. This is of the horizontal type and actuated by a large steel spring in the base. Pivoted to the end of the cross arm is a secondary arm which carries the mould and crucible. In operation the arm is rotated in the reverse direction against the spring mechanism, the winding being continued to the tension required to give the desired forward rotational speed during the actual casting. The beam is then held by a catch in the "wound up" position.

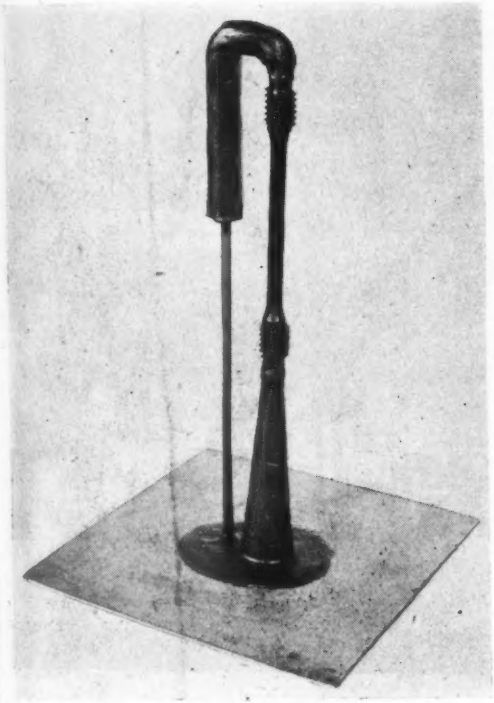

FIG. 9.—WAX ASSEMBLY FOR TEST-PIECE MOULD.

Following this, the alloy is melted in the crucible by the blowpipe flame. When the melt is in the proper condition the catch is released. As the machine starts the secondary arm is at right angles to the main arm, so that the molten alloy follows a straight path into the mould because the inertia of the metal at the start tends to keep it in its original position after the crucible and flask are started in motion. As the speed of the machine increases, the force changes until it is in line with the main arm, and the secondary arm, being pivoted and free to move, stays in line with the force at all times. The result is that the alloy travels in a straight line directly into the mould cavity, undisturbed by any motion towards the side.

Small electric arc furnaces are also used, as shown in the cross-sectional view in Fig. 7.[3] This unit consists of a totally enclosed indirect arc furnace which is mounted on trunnions and is capable of being inverted. When the furnace charge is properly melted the mould is placed in an inverted position on the top of the furnace, the furnace exit coinciding with the mould entry. The mould is clamped in this position

FIG. 10.—AN ARC FURNACE SUITABLE FOR THE PROCESS.

and pouring is effected by inverting the furnace. When in the inverted position, air under pressure is automatically admitted to the furnace chamber through a trunnion, as shown at "H" in Fig. 7, and the molten alloy forced into the finest detail in the mould cavity.

Application to Jewellery Casting

An application of the process to the manufacture of jewellery is described in British patent specification No. 449,062. In this, the article to be made is carved in wood or other easily worked medium. Using this carving, a rubber mould is produced, from which as many wax patterns as required are made, the flexible nature of the mould permitting the easy removal of the wax model, even though this may contain certain undercuts. From this wax pattern a mould can be prepared in a similar manner to that outlined for the production of dental plates.

In the modern development of the lost wax process, as applied to engineering castings, the first stage is the making of the master mould to be used in the

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production of the wax pattern. Such moulds can be made in brass or steel by conventional machining methods, by casting in a tin-bismuth alloy or in vulcanised rubber. If only a small number of castings are required this mould can be made in plaster. When the casting contains undercuts this mould is made

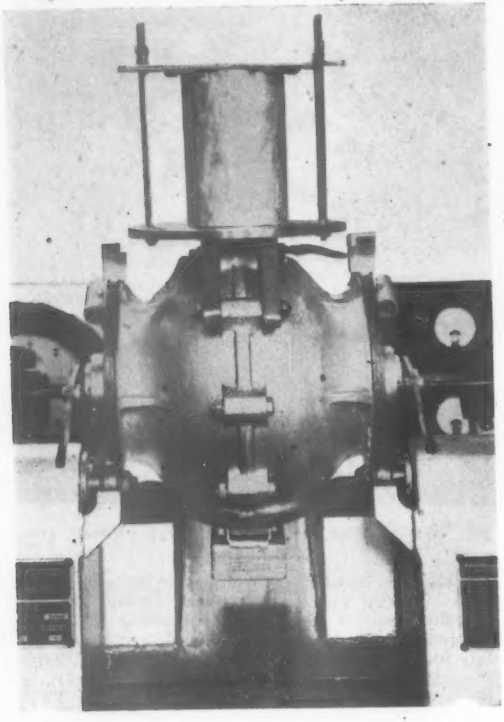


FIG. 11.—MOULD CLAMPED TO THE FURNACE BODY.

with removable sections. The wax patterns produced from the master mould can be treated as described in the making of dental plate moulds.

Use of Silicon Esters

For the casting of bronze and dental alloys having a gold base, moulding materials based on plaster of paris are quite satisfactory. However, in casting alloys of higher melting point, the ordinary plaster-silica sand mixtures are not sufficiently refractory. The plaster, which is the bonding agent, decomposes at the high temperatures necessary. Sodium silicate used as a binding agent for silica sand permits of higher casting temperatures, but when set, the final composition includes a sodium salt, with a consequent reduction in refractoriness. This disadvantage when using sodium silicate for high temperature casting has been overcome by the use of certain organic silicates known as silicon esters, which, when hydrolised, undergo a spontaneous transformation, with the ultimate formation of pure silica.[3] [4] The following are the reactions between ethyl silicate and water[5]:—

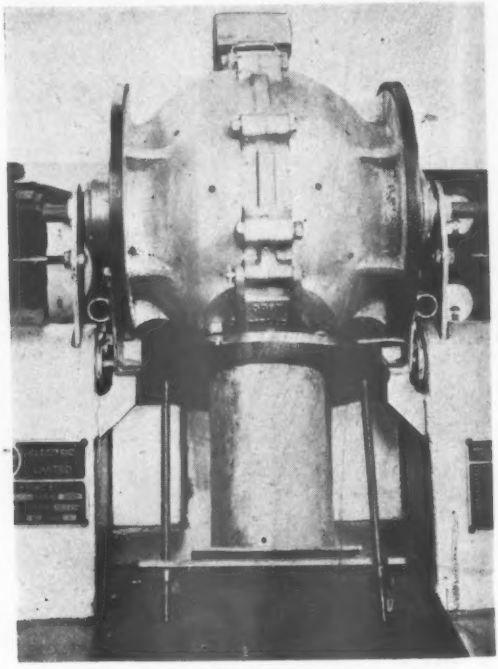


FIG. 12.—FURNACE IN THE CASTING POSITION.

$$Si(OC_2H_5)_4 + 2H_2O = SiO_2 + 4C_2H_5OH$$

or

$$Si(OC_2H_5)_4 + 4H_2O = Si(OH)_4 + 4C_2H_5OH$$

That is, silica or silicic acid and alcohol are formed. The speed of the reaction and the nature of the siliceous products is influenced by many factors, including temperature, composition of the solution, and the presence of electrolytes, and under suitable conditions solutions of this kind can be used to form a film of colloidal silicic acid around particles of sand, which binds the particles together, and slowly hardening, produces a strong mass.

By the use of this binding medium, moulds can be produced by the lost wax process which are sufficiently refractory to enable alloys of high pouring temperatures to be successfully cast.

The following description of the method of making a test-piece mould may be taken as typical of the procedure. In Fig. 8 are shown three moulds and the wax patterns produced from each. An accurately machined metal mould is used for the test-piece portion, but plaster moulds can be used for the runner and feeder, since a high degree of accuracy is not required for these parts. The three wax components are stuck together, the joining operation being carried out by a heated dental spatula. The assembly is shown in Fig. 9, fixed by wax to a plate. A metal rod is used to support the feeder. A metal cylinder is placed over the wax assembly and fixed by wax or other means to the base plate. The moulding sand is mixed with the binder solution to give the consistency of cream and is poured into the cylinder. The mould is vibrated, during which the sand settles and the excess liquid rises to the top and is poured off, the investment under the liquid being quite hard. After setting of the binder the wax is melted out and the mould heated to a red heat.

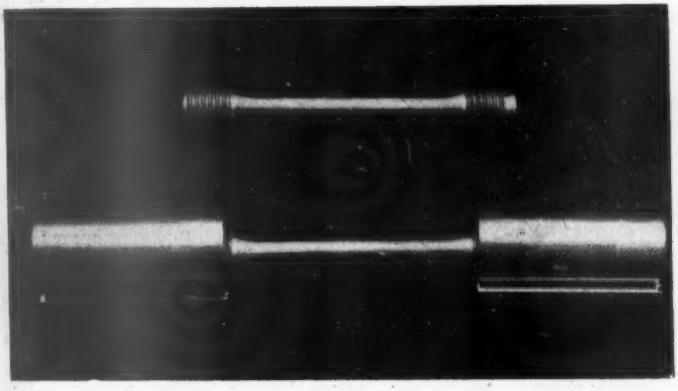


FIG. 13.—TEST-PIECES IN THE "AS-CAST" CONDITION.

TABLE I.—*Some Typical Figures.*

Dimensions of Mould for Wax Patterns.	Dimensions of Monel Castings.		Dimensions of Nickel Castings.	
	1.	2.	1.	2.
Inches.	Inches.	Inches.	Inches.	Inches.
A ... 2.00	1.955	1.955	1.954	1.955
B ... 3.00	2.928	2.932	2.930	2.928
C ... 4.00	3.904	3.908	3.905	3.909

A furnace of the type shown in Fig. 10 has been successfully adapted for the process. This furnace is the Birlec Detroit Indirect Arc Model "N," and can melt up to 10 lbs. of steel, high-nickel alloys, bronze, etc. When the furnace charge is properly melted, the hot mould is clamped to the furnace, as shown in Fig. 11, which is a close-up of the furnace body with an attachment fitted to take the mould. Fig. 12 shows the furnace in the casting position.

Fig. 13 is a photograph of two test-piece castings produced by this method, the only treatment given to the castings being a light shot blasting to remove the sand. The accuracy of the threaded portion is indicated by the ability to screw direct into the test machine grips without machining. The wax pattern was adjusted to compensate for shrinkage in the casting. These castings made in a high melting point alloy illustrate the suitability of the process for casting alloys having a melting point in the region of 1,450 deg. C., and a casting temperature of over 1,600 deg. C.

A further indication of the accuracy obtainable is shown by the dimensional measurements made on some Monel and nickel castings of shape shown in Fig. 14. This shape of test casting was developed to enable accurate micrometer measurements to be easily made. Table I also records some typical figures.

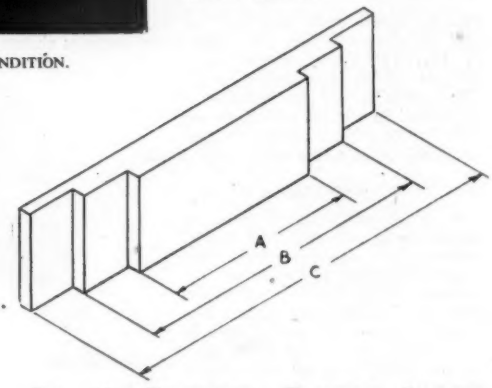


FIG. 14.—DIMENSIONAL TEST-PIECE SHOWING ACCURACY OBTAINED ON MONEL AND NICKEL CASTINGS.

These results also indicate the shrinkage allowance to be made for these alloys, and this particular technique when constructing the wax pattern mould. For maximum degree of accuracy in all dimensions the final size of the wax pattern mould is best ascertained by trial and error. The finished casting is accurately measured, and any necessary adjustment made to the wax pattern mould.

Figs. 15 to 20 indicate to some extent the type of

The Lost Wax Process

article which can be produced by the process, of such accuracy and excellence of surface finish that little, if any, machining is required. In Fig. 15[6] are shown three precision castings: (*a*) a brass connecter arm; (*b*) a bevel gear; (*c*) an aluminium alloy compressor head. Fig. 16[6] shows various small parts cast by the process. Fig. 17[6] illustrates a pressure gauge and its parts.

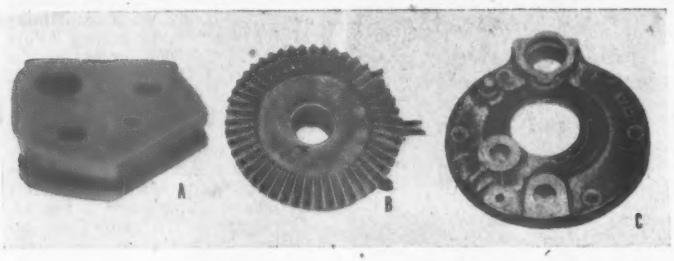


FIG. 15.—THREE PRECISION CASTINGS.
A—Connector Arm. B—Bevel Gear, C—Compressor Head.

Various small parts cast by the process in stainless steel are shown in Fig. 18.[7] The brass castings shown in Fig. 19[7] illustrate the sharp threads which can be obtained. The versatility of the method is illustrated in Fig. 20[7] which shows, from left to right, castings in stainless steel, brass and aluminium.

Vote of Thanks

In proposing a hearty vote of thanks to the lecturer, MR. G. W. BROWN recalled hearing Mr. Sheehan giving a Paper on the subject. Mr. Dunlop's able expansion of the subject caused him to reflect upon his early years in the foundry trade. In those days no one dared to speak on foundry matters outside the foundry. During the last fifty years the technique of the foundry had so developed that it had been taken out of the hands of the practical man and put into those of the scientific man. To-day any foundry which could make castings needing the minimum of machining was justified in getting a fair price for them. The Branch was to be complimented in having as a member a man possessing the abilities of Mr. Dunlop.

MR. H. G. HALL, in seconding, described it as almost a unique lecture. Doubtless many of them were wondering if they could try its technique in the production of their patterns. It seemed to him there were possibilities in it. One interesting point was the use of ethyl silicate as a binder, and he wondered if there was any possibility of using that as a binder for furnace linings. He must congratulate Mr. Dunlop on the excellent way in which he had dealt with a particularly intricate matter.

In acknowledging the vote of thanks, MR. DUNLOP assured Mr. Hall that it was possible to use ethyl silicate in the manner he suggested. In fact, it had been done, and it could also be used as a binder for mould dressing for sand moulds.

DISCUSSION

MR. A. G. ROBIETTE opened the discussion, remarking that from the samples sent round it would appear that the material immediately adjacent to the pattern was of a much finer consistency, or that the pattern was sprayed with a finer material, or that material was floated on to the pattern by the jolting process. He

FIG. 16.—A COLLECTION OF SMALL PARTS MADE BY PRECISION CASTING.

FIG. 17.—PRECISION CAST PARTS FOR A PRESSURE GAUGE.

would like to know to what temperature the mould was heated to decompose the silicate. The use of the process seemed to be of the greatest advantage in its application to metals which were extremely difficult to machine, or in which the shape was so complicated as to necessitate an extensive process of machining. Had Mr. Dunlop any information regarding its general use for small castings which were usually made in a casting machine? Some complication was likely to arise if the moulds had to be heated when put on the machine. He wondered if Mr. Dunlop could give them the distribution of costs of making castings by that process, the cost of moulding, bond, making the pattern, and so on.

MR. DUNLOP replied that the placing of a much finer material against the face of the pattern could be done by spraying. The setting of the binder could be effected in two ways. Heating was one of them, and it could also be effected by the use of a chemical accelerator. The moulds must be used hot, and there might be difficulty in handling a number of moulds on a machine. He had not cast anything weighing much above a pound, but had cast a number of castings assembled in one moulding box. The application of the process to mass production was quite possible. He was sorry he could not give Mr. Robiette any information regarding the cost of making a casting.

In reply to Mr. K. G. Williams, the lecturer pointed out that one melting was necessary for every mould.

Replying to Mr. F. Hudson, MR. DUNLOP said the commercial application of the process to bronze casting all depended on the type of casting to be produced. If it was an intricate casting it would be an economic proposition if it entailed much machining time. It depended on the nature of the casting. If it was a simple bar on which little machining was required he would not cast it by that process. If, for example, it was a small complicated gear, it would be an advantage to cast it that way. As to the best investment for bronze casting, one based on plaster of paris could be used. In the question of using a carbon investment, the only reference he had seen to the use of a carbonaceous moulding material was its use instead of silica sand with a clay type of binder. He had no knowledge of the use of the carbonaceous type of binder.

MR. A. J. SHORE thought the lecturer had made a practical contribution to foundry technique, and he wondered how far it would go. There was no real reason why it should be limited to small castings unless it was merely a matter of expense. He thought a large percentage of malleable castings could be made by a similar process. He would like to know a little more about the production of the wax pattern, and how it was controlled.

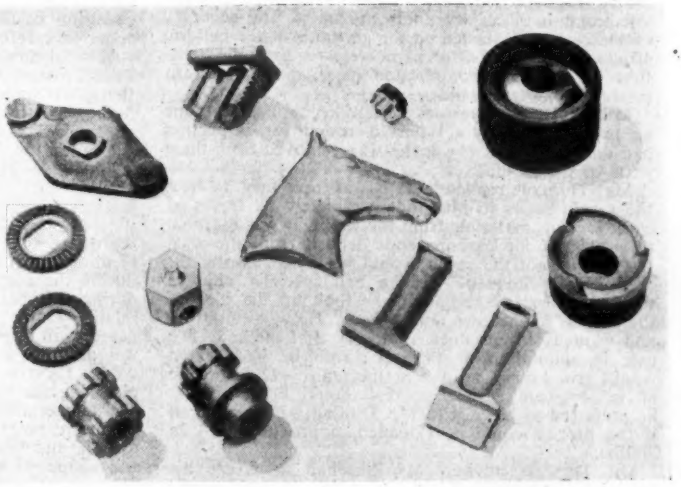


FIG. 18.—STAINLESS STEEL CASTINGS PRODUCED BY THE NEW TECHNIQUE.

The Lost Wax Process

MR. DUNLOP explained that the principle was not quite that adopted in the casting of large statues. In making large statues the wax pattern was made and built up on a core which supported it. One of the difficulties in making big castings was the possibility of distortion of an unsupported wax pattern. The shrinking of the wax also came in. There seemed to

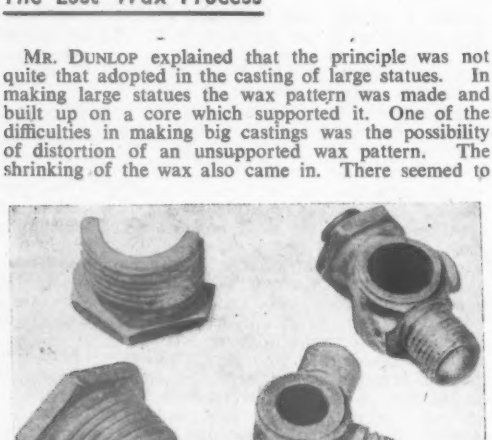


FIG. 19.—BRASS CASTINGS SHOWING THE SHARP THREADS WHICH ARE OBTAINED.

be some hope that a synthetic resin might be used instead of wax. In producing a wax pattern a split mould was used. It was clamped together and wax was injected into the cavity under pressure. The accuracy of the casting depended on the accuracy of the pattern. If a sufficient number of parts were required the question of making a complicated metal die for pattern production was possible.

MR. T. H. TAFT remarked that he noticed that one or two of the castings passed round for inspection had undercuts. How was the wax removed from these parts of the mould?

MR. DUNLOP replied that it was necessary to heat the mould so as to burn out completely all traces of carbonaceous materials from the wax. It was essential to get rid of the carbonaceous deposit from the wax. If they did not the result would be a bad casting.

MR. J. J. SHEEHAN said he had specially enjoyed the lecture because originally he took up the idea of the process for his own amusement. He was ambitious and wanted to reproduce a rose by that method. To cast in aluminium or bronze a rose he had grown would give him a permanent memento and would be an achievement. He thought it could be done, but he preferred to leave it to Mr. Dunlop. He wondered if the process could be extended to produce tools in Stellite.

MR. DUNLOP advised Mr. Sheehan to freeze his rose before he invested it the next time he was experimenting. Regarding the making of Stellite tools by the process, there would be no difficulty at all in getting the shape, but he would not like to say how it would behave as a cutting tool. He thought tungsten high-speed steel tools could be cast by the process. They would require a little machining before use.

MR. A. TIPPER said that, like Mr. Dunlop, he had some troubles with the process. When one had produced the wax pattern one had to maintain its size, and wax being wax one had to control it at a certain atmospheric temperature, and care had to be taken in

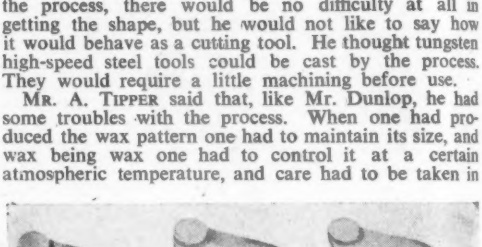


FIG. 20.—CASTINGS IN THREE METALS—STAINLESS STEEL, BRASS AND ALUMINIUM.

handling it. What was a useful working atmospheric temperature for storing wax? He wondered if Mr. Dunlop had explored the change in the dimensions in the wax. In his opinion the two chief problems in connection with the process were first of all cost, and secondly, accuracy. Everyone would agree that in the production of aluminium castings for example the process could not compete with die casting in regard to precision castings. The lost wax process of casting required careful attention to all details to achieve this successful dimensional accuracy. The write-ups in the Press, particularly from America, did not emphasise that point sufficiently. Recently figures of accuracy of 3 and 5,000ths had been given. Mr. Dunlop said plus or minus 2,000ths. He thought that was a good indication of the best they were likely to get in normal production. He wondered how Mr. Dunlop fed the stepped bar. Another new point to be decided was just what happened to the investment after it had lost its wax, and the mould heated. Had he been able to reproduce time after time to the degree of accuracy mentioned consistently, or did he get much scatter due to the contraction or expansion of the investment during the heating process. What was his opinion relative to the advantages of centrifugal casting compared with pressure casting, and finally what method was used for controlling the casting temperature?

MR. DUNLOP said that Mr. Tipper was right in emphasising the need for attention to be paid to details. The temperature in which to store the pattern was an important point. One of the main difficulties was distortion, and that was bound up with the temperature and shape of the pattern. When an awkward shape

(*Continued on page* 118, *column* 2.)

RESTORATION OF PRE-WAR TRADE PRACTICES ACT

By F. J. TEBBUTT

With various Acts contemplated during this Parliamentary session concerning peacetime industry, the Restoration of Pre-war Trade Practices Act, 1942, passed some time ago in readiness for peace, should be noted as being in juxtaposition with these measures. At the outset it should be noted that the term "trade practice" means any rule, practice, or custom (whether by virtue of contracts of employment or otherwise) observed in the particular undertaking or industry with respect to the class or classes of persons to be or not to be employed therein, or with respect to the conditions of employment, hours of work or working conditions of the persons or any class of the persons so employed, such, as example, questions of boys or girls, men or women, dilution matters, hours of employment, duration of working week, overtime matters, proportion of youths to men, skilled or semi-skilled definition for certain operations, processes according to age or experience, apprenticeship matters, and so forth.

The Fundamental Principle

The chief provision of the Act is that where any trade practice in operation immediately before September 3, 1939, has been departed from since that date, the employer is required to restore the practice within two months from the end of the war, and to maintain the practice for at least 18 months (dating from when the restoration is effected or the end of the war period—a date to be appointed by the Ministry of Labour—whichever is the later). If the firm is concerned with munitions of war (term includes articles, materials and devices as well as actual armaments, ammunition, ships, aircraft and so forth), the restoration obligation applies in respect of practices in operation on April 30, 1939, and departed from after that date, instead of September 3, 1939 (the start of the war) applying as ordinarily.

Arbitration Matters

A trade union or association of employers, domestic to the particular industry can report to the Ministry if it considers that an employer has not conformed to the Act as regards restoration, etc., and the Ministry must then refer the matter to any existing machinery domestic to the industry for settling these matters, or if there is no such body refer the matter to an arbitration tribunal (appointed by the Ministry of Labour) or take such steps as may appear advisable.

Where an arbitration tribunal finds that the employer is at fault, the award must state plainly where the employer has failed to discharge the obligations of the Act (with details of the trade practice in question), and indicate what steps he is to take to carry out the obligation. The award must also state for how long the practice is to be maintained; the period cannot expire later than 18 months from the date of the award, but may take effect from the date of the award or from an earlier date, although this cannot be earlier than the date when the matter was reported to the Minister. Furthermore, the tribunal can order a sum to be paid employees, where the non-observance of the trade practice has produced less remuneration than if the practice had been observed.

No penalty follows until default in an arbitration award occurs, when the employer if convicted (summary court proceedings) may be fined anything up to £50, with, if he continues to default, a fine of anything up to £50 for each day the default continues after the first conviction.

Special Points

The Act applies to concerns commenced during the war period as to older establishments, the practice to apply post-war being practices common to undertakings of a similar nature to the new firm. To meet the case where it may be thought that a trade practice introduced during the war period should be retained, it is permissible for the obligation of the Act to be modified or waived, if agreements are made between employers either individually or by an association of employers) and trade unions, but the trade union must be one whose custom it was pre-war to maintain trade practices in the particular industry or undertaking.

FUTURE OF A MAGNESIUM FACTORY

MR. BURKE asked the Minister of Aircraft Production to state the cost to the Government of the M.E.L. factory built in the North-West area for the manufacture of magnesium, now discontinued; how long production was maintained; and what the Government proposed to do with the buildings and the machinery.

SIR STAFFORD CRIPPS said that the factory was State-owned, and cost £4,350,000. Production commenced in April, 1943, and was discontinued at the end of 1944. The factory was managed, on an agency basis, by Magnesium Elektron, Limited, whose shares were partly held by I.C.I., Limited; but neither company had any direct interest in the factory. Consideration was being given to possible uses for this factory; at present it was being retained on a care and maintenance basis, as stand-by capacity to be used in an emergency.

ESSENTIAL WORK ORDER AMENDMENT

The Minister of Labour and National Service has made an Order amending certain provisions of the Essential Work (General Provisions) (No. 2) Order, 1942.

Under the provisions in question notice to terminate the employment of a specified person in a scheduled undertaking may be given by either party before the permission of a National Service Officer has been granted, and if the notice has expired, the granting of permission enables the employment to be terminated at once. The present Order now makes provision so that the permission when granted will not be effective until at least seven days after the application for permission has been received at a local office of the Ministry of Labour and National Service. The requirement as to notice is not affected.

CORRESPONDENCE

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

GEAR SWEEPING

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—In reply to your correspondent, Mr. G. W. Douglass, we should like to make it clear that the point he makes regarding the extension to the drag sweep stick in order to sweep the joint has already been taken care of in our method.

As described, such an extension is allowed for in the cope sweep stick which projects a distance of 3 or 4 in. beyond the rim impression (Fig. 8). This sweeps the joint or "parting" which is not interfered with in the subsequent operations. In sweeping the drag half, the sweep stick is the exact outside diameter of the wheel, and therefore does not interfere with the previously swept joint, which, obviously, needs no additional setting.

It may be that Mr. Douglass rams his top parts up separately or does not sweep them in the manner indicated in our Paper. Such little variations in technique are inevitable between one locale and another and, in our opinion, demonstrate the virility of jobbing moulding practice.

We are not very keen on your correspondent's suggestion of chilling the spur face. "Densening" is obviously meant here, since the effect is to close the grain and inhibit shrinkage. Admittedly, this method would tend to control the solidification rate and thus, by evening up temperature gradients, at least drive the shrinkage defects away from a vital machined surface.

On the other hand, the introduction of metal denseners into a greensand mould has many attendant disadvantages, the chief among which might be the risk of "blown" castings. The major trouble in our case was, by the way, not "graphite growth" or open grain, but a form of gross shrinkage cavitation due to lack of feeding metal.

We thank Mr. Douglass for the interest he has shown and hope that this information will satisfy him. —Yours, etc.,

WILLIAM MONTGOMERY,
J. DOIG, JUN.

Henry Balfour & Co., Ltd.,
Durie Foundry,
Leven, Fife.
January 24, 1945.

B.C.I.R.A. ELECTS NEW MEMBERS

The following firms have been elected members of the British Cast Iron Research Association, the name of the official representative being given between brackets:—A. F. Craig & Company, Limited, Caledonia Engineering Works, Paisley, Scotland (Mr. A. F. Craig); Platt Malleable Castings, Limited, Leamore, Walsall (Mr. Gilbert Harvey).

As Trade Member:—Newey Wearing, 36, Parkdale, Wolverhampton (Mr. H. S. Wearing).

As an Associate Member:—Mr. Basil F. Chick.

THE LOST WAX PROCESS

(*Continued from page* 116.)

was being made it could be stored on a jig made of plaster. He believed some people were storing wax patterns in refrigerators, but that depended upon the type of wax used. The temperature should be kept as low as possible. Regarding the accuracy of reproducibility on simple shapes like the test-piece there would not be much trouble. The question of changes in the moulding mass must also be tied up with what was used for moulding material. With silica sand there were definite volume changes on heating. On the question of adjusting the wax pattern to make good any shrinkage the figures were only given to show how accurately such castings could be made. The best way was to make a model of the job, and estimate the shrinkage allowance before making the wax pattern. After casting, size it up, and if irregularities are found correct the pattern and try again. He had had little experience of centrifugal castings having used a high frequency furnace and later an arc furnace with the pressure device illustrated. The question of casting temperature determination in a small arc furnace was difficult, and he was engaged at the moment on the problem.

In declaring the meeting closed, the PRESIDENT (Mr. G. R. Shotton) thanked Mr. Dunlop for his address, remarking that it had proved extremely interesting, and undoubtedly there was a big field for development of the process.

REFERENCES

1 "The Alfred David Lentz System of Lost Wax Casting," 1933. National Sculpture Society, New York.
2 "Metal Industry," London, April 7, 1944.
3 British Patent 290717.
4 British Patent 418160.
5 "Silicon Esters and their Application to the Print Industry." Journal of the Oil and Colour Chemists' Association. Vol. XIII. No. 116. Feb., 1930.
6 "Metals and Alloys," October, 1943.
7 "Iron Age," July 9, 1942.

Z.D.A. ABSTRACTS

The Zinc Development Association, of Lincoln House, Turl Street, Oxford, have now issued a booklet of Abstracts in printed form. It is believed that this form adds greatly to their appearance, while having a further advantage of permitting an increase in circulation owing to the saving in the weight of paper used. Readers interested in receiving these Abstracts, and who would like to make use of the Association's library facilities, can have their names and addresses added to the existing mailing list. It is to be noted, however, that Abstracts printed on one side of the paper only will no longer be available; but a second copy will be supplied to anyone who wishes to cut out Abstracts for filing purposes.

Tecalemit, Limited, high-pressure lubrication specialists, propose to increase the capital from £500,000 to £750,000 by the creation of 1,000,000 5s. shares.

FUEL CONSUMPTION PER UNIT OF OUTPUT.

BRONZE, BRASS AND IRON FOUNDRIES

The Ministry of Fuel and Power, through its Fuel Efficiency Committee, announces that it has studied the summaries of returns to *questionnaires* issued by certain of the Industry Fuel Efficiency Committees to their members on fuel consumption per unit of output.

The following paragraphs summarise the figures obtained from the bronze, brass and iron foundries.

Bronze and Brass Founders

Bronze and Brass Casting.—Variations in the type of castings made and in the amount of core drying required indicate that the arithmetic mean is of little value as a yardstick. There was also no modal group, the spread of consumption being remarkedly even between 0.4 and 4.3 tons per ton. Comparing the figures from 51 firms for 1943 against 1942, 36 firms showed reduced consumption, 17 of which were over 15 per cent., and 11 over 25 per cent., and 14 firms showed increases in consumption. The average specific consumption was reduced from 0.906 to 0.862, *i.e.*, 4.4 per cent.

Ironfounding Industry (Plant other than the Cupola)

Mould and Core-drying Stoves.—In view of the difficulty of estimating the weight of output, fuel consumption was related to stove capacity. It was found that the size of the stove had a marked influence on the efficiency of heat utilisation; when fully loaded, the bigger the stove the less fuel required for drying unit quantity of sand.

Melting Furnaces.—In the case of air furnaces and rotary furnaces, the method of firing appears to have little influence on fuel consumption. The range for the former was from 8 to 20, and for the latter 2.5 to 10, both expressed as cwt. of coke (or equivalent) per ton of iron melted. Crucible melting of cast iron is generally only done in small foundries for small quantities of iron, and in such circumstances control of fuel usage is difficult. The range for crucible furnaces was from below 5 to 25 cwts. per ton.

Annealing Furnaces.—In the case of malleable cast iron, furnaces fired by pulverised fuel or producer gas had an average specific consumption of 11 as against 29.3 for hand-fired furnaces. The high average for the latter is partly accounted for by a number of very old and obsolete furnaces. The range was from 5 to 50 cwts. per ton. The comparatively small number of firms producing grey cast iron, and the variation in the amount of heat-treatment required (depending on the properties desired in the finished casting) has lessened the value of the figures for this group, but the two highest specific consumptions should be capable of reduction.

Visits paid by members of the Regional Panels of the Ironfounding Industry Fuel Commitee have shown that local factors have had to be taken into consideration, but in very many cases recommendations for improving fuel efficiency have been put into effect.

MACHINE TOOL CONTROL RELAXED

RE-EQUIPMENT OF INDUSTRY

It has been decided to replace comprehensive control of machine tools by "selective control" applied to scarce types and to the most vital requirements. The new arrangements are embodied in a new Order, the Control of Machine Tools (No. 14) Order (S.R. & O., 1945, No. 56), available at H.M. Stationery Office.

As from February 1, it is no longer necessary for an acquirer to obtain a purchase certificate before placing an order for any metal-working machine tool or for any measuring instrument or measuring machine coming within the purview of the Machine Tool Control.

The production and allocation of scarce types of machine tools will be planned by placing these types on a "Nominated List," and orders for any of these machines will only be accepted by suppliers under the authority of "Supply Certificates." For all other new machines it will be sufficient for suppliers to advise the Control of the acceptance and completion of orders, and any orders of exceptional importance and urgency will be dealt with by means of "Preferential Delivery Instructions."

Price Control Dropped

It has also been decided that as from February 1 new orders for new metal-working machine tools will not be subject to statutory price control. This will permit a reversion of the normal contract conditions applying to most types of engineering equipment. Price control will, however, continue to apply to all firm orders for home and export outstanding at January 31, 1945. It is pointed out that in view of the continuing importance of machine tools, the Government cannot disregard the trend of prices, and the power to reimpose price control is therefore being retained.

The abolition of licensing for used machine tools will give users greater freedom for the purchase of such Government surplus machines as are not held in reserve for possible war uses. Although a large surplus is unlikely to emerge during the German war, planning for ultimate reconversion requires knowledge of the availability and price of all Government surplus tools. This surplus is now in the charge of the Machine Tool Control. As from February 1, sales from this M.T.C. Pool will be on a new price basis, which has been fixed "at a level favourable to purchasers in order to facilitate the re-equipment of industry." Sales on this new basis will be restricted during February to requirements sponsored by a Government department. By March 1, however, the Machine Tool Control will have complete price lists of all available Government surplus machines in at least five disposal centres outside London, so that intending purchasers in the provinces can investigate availability and prices without travelling to London.

Long-term disposal plans are under consideration, and there will be full consultation with the trade interests concerned.

DEATH OF MR. PERCY PRITCHARD

It is with regret that we announce the death of Mr. Percy Pritchard, the president of the British Cast Iron Research Association, and an outstanding figure in the foundry industry. He was only 52 years of age; yet he had built up one of the largest foundry organisations in Europe. One of his earliest efforts was the Midland Motor Cylinders Company, which he founded in 1915. Then he became interested in the Birmingham Aluminium Castings Company, while still later he formed Pneulec, Limited, which has grown to be among the foremost foundry equipment houses. In recent years many of the companies in which he was interested were linked up by the formation of Birmid Industries, Limited. This included the manufacture of magnesium castings by the Sterling Foundry Company, of Coventry. This by no means exhausts the list of foundries and forges included in the vast enterprise of which he was the leading spirit. In saying this (and Pritchard would have been the first to stress the fact) we are aware that there has been thorough-going team work throughout its history.

Pritchard's success was due to his ability to "think big," while still keeping his schemes well within the bounds of practical realisation. Though he became a commercial magnate, no detail was too small to attract his interest. He interrupted the last visit we made in his company to one of his works, to dismantle an experimental die-casting machine in which he was particularly interested. Throughout life he never quite shook off his natural quiet modesty. Thus, as a public speaker, it was his inherent common sense, rather than his powers of oratory, that commanded the attention of his audience. The only public recognition of his great services to industry—especially the foundry industry—has been made by the Institute of British Foundrymen by the award in 1943 of the E. J. Fox Medal. It was largely due to Pritchard's enterprise that the B.C.I.R.A. was able to acquire its beautiful new buildings at Alvechurch.

Pritchard must be classed among the most enlightened of modern industrialists. He was courageous in leadership, sympathetic in his dealings with labour, an enthusiastic supporter of research, and an enterprising publicist. His career will long serve as an object lesson for the neophyte foundryman, as his success was due to sheer "grit."

LIEUT.-COL. DENYS L. SELBY-BIGGE, T.D., who helped the late Sir Charles A. Parsons in his development of the steam turbine, has died in London. He was 80 years of age.

MR. DOUGLAS A. MACCALLUM, secretary and former vice-president of the West of Scotland Iron and Steel Institute and past-president of the Society of Chemical Industry, died recently in Glasgow.

MR. ARTHUR WOOD, who, prior to his retirement, was for many years commercial manager of the Ayrton rolling mills of Dorman, Long & Company, Limited, has died at Middlesbrough, in his 70th year.

NEWS IN BRIEF

THE SILICA SAND COMPANY, LIMITED, is being wound up voluntarily. Mr. A. E. Sanders, 216, Martins Bank Building, Liverpool, is the liquidator.

THE BETHLEHEM STEEL CORPORATION has returned a net income for 1944 of $36,167,723, equal to $9.93 per common share, compared with $32,124,592, or $8.58 per share, for 1943.

SETTLE LIMES, LIMITED, have given notice that the whole outstanding 5½ per cent. first mortgage debenture stock (less the £22,927 stock drawn for redemption on January 31) will be repaid on July 31 at 103.

PRE-APPRENTICESHIP COURSES in engineering are planned by Glasgow Corporation Education Committee, which already offers pre-vocational training to youths entering the building industry. Courses in other trades are being considered.

SHAREHOLDERS OF THE Park Gate Iron & Steel Company, Limited, have approved resolutions for the reduction of capital. The scheme will now be submitted to the Courts. It provides that 2,000,000 £1 ordinary shares be reduced to 10s. each.

ANOTHER STRIP MILL is to be erected in South Wales. Richard Thomas & Baldwins, Limited, Guest Keen Baldwins Iron & Steel Company, Limited, the Briton Ferry Steel Company, Limited, and the Llanelly Steel Company, Limited, are jointly concerned in the project.

THE CONTROL OF INDUSTRIAL ELECTRICAL EQUIPMENT (No. 3) ORDER, 1945, which came into force on February 1, exempts the acquisition and disposal of all used industrial electrical equipment from the licensing requirements. Regulations applying to new industrial electrical equipment are unchanged.

THE MINISTRY OF SUPPLY announces that, in view of the greatly improved supply position of high-speed steel twist drills, it has been decided that there is now no longer any necessity to continue the Control of Machine Tools (Twist Drills) (No. 1) Order, and, accordingly, this Order has been revoked.

F. H. LLOYD & COMPANY, LIMITED, steel founders, of Wednesbury, propose to increase the authorised and issued capital of £300,000 by £200,000, and to issue 71,428 £1 ordinary shares at 28s. each to ordinary holders in the proportion of seven new shares for every 25 held. The capital is needed so that extensions to and adaptations of the company's plant and equipment may be got ready to meet post-war needs.

A JOINT MEETING of the Cleveland Institution of Engineers and the Iron and Steel Institute will be held at the Cleveland Scientific and Technical Institute, Corporation Road, Middlesbrough, on February 19, at 6.30 p.m. Mr. Leslie F. Wright, President of the Cleveland Institution of Engineers, will take the chair. Mr. G. D. Elliot will present the Paper by himself and his colleagues on "Ironmaking at the Appleby-Frodingham Works of the United Steel Companies, Limited."

THE MODERN PIG

STANTON

IF YOU WANT...
clean iron, free from sand, free from sows ...uniform analysis... convenient size...easy handling... specify
STANTON MACHINE CAST PIG IRON

SPECIFICATION

WEIGHT	80-90 lbs.
Length	22 inches
Width	8½ inches
Thickness	3⅜ inches

(at notch 2½ inches).

Made in our well-known
STANTON, HOLWELL & RIXONS BRANDS

THE STANTON IRONWORKS COMPANY LIMITED NEAR NOTTINGHAM

COMPANY RESULTS

(Figures for previous year in brackets.)

United Gas Industries—Interim dividend of 5% (same).

Warner & Company—Interim dividend of 2½% (same).

Wombwell Foundry & Engineering—Interim dividend of 6% (same).

S. E. Opperman—Net profit, £92,963 (£66,448); dividend of 12½% (same).

Steel Corporation of Bengal—Interim dividend on the ordinary shares of 3¼% (same).

Bull's Metal & Melloid—Profit to September 30, £21,478; depreciation, £5,392; taxation, £8,775; dividend of 5% (same); forward, £14,179 (£10,802).

International Combustion—Gross profit for the year to September 30 last, £218,172 (£212,249); taxation, £127,361 (£105,860); final dividend of 15% (same), plus a cash bonus of 12½% (10%), making 32½% (30%).

Shanks & Company—Profit for 1944, after tax, depreciation and other charges, £41,361 (£58,087); final dividend of 9½% (same), making 12½% (same); to war contingencies, £20,000 (£25,000); forward, £60,766 (£60,912).

John Bolding & Sons—Net profit for 1944, after taxation and depreciation, preference dividend and staff bonus, £10,074 (£8,528); final dividend of 8%, making 12% (same); to reserve for contingencies, £2,500; forward, £31,850 (£30,276).

Weyburn Engineering Company—Profit for 1944, after depreciation and E.P.T., £33,133 (£34,005); income-tax, £16,100 (£17,500); to general reserve, £5,000 (same); final dividend of 22½%, plus a bonus of 5%, making 35% (same); forward, £1,768 (£2,035).

NOTES FROM THE BRANCHES

London Branch (Slough Section).—The next meeting will be held on February 15, at 6.45 p.m., in the lecture theatre of High Duty Alloys, Limited, Slough, when a lecture will be given by Mr. F. G. Evans (Langley Alloys, Limited) on "Practical Aspects of Bronze Foundry."

Bristol and West of England Branch.—The hon. secretary, Mr. A. Hares, announces that a meeting is to be held on March 3, at 3 p.m., at the Imperial Hotel, Exeter, when Mr. H. Plucknett is to read a Paper on "Plaster and Plastic Patternmaking and Low-temperature Melting Point Alloys." This, we believe, is the first time that a lecture under the auspices of the Institute has been held in that city.

DR. H. T. ANGUS, has joined the staff of the British Cast Iron Research Association in the capacity of manager of the Development Department. He was formerly on the staff of the Parkinson Stove Company, Limited. A second appointment is that of MR. W. L. CARTER as manager of the Intelligence Department. He comes to the Association from K. & L. Steelfounders & Engineers, Limited, where he was head of the publicity department.

PERSONAL

MR. R. ANTROBUS LYNEX has been appointed secretary of Imperial Chemical Industries, Limited.

MR. S. MORLEY PARKIN has completed 50 years' service with Ambrose Shardlow & Company, Limited, Sheffield.

MR. A. DYSON, joint managing director of Horseley Bridge & Thomas Piggott, Limited, Tipton, has been elected president of the Birmingham, Wolverhampton and Stafford District Engineering and Allied Employers' Association.

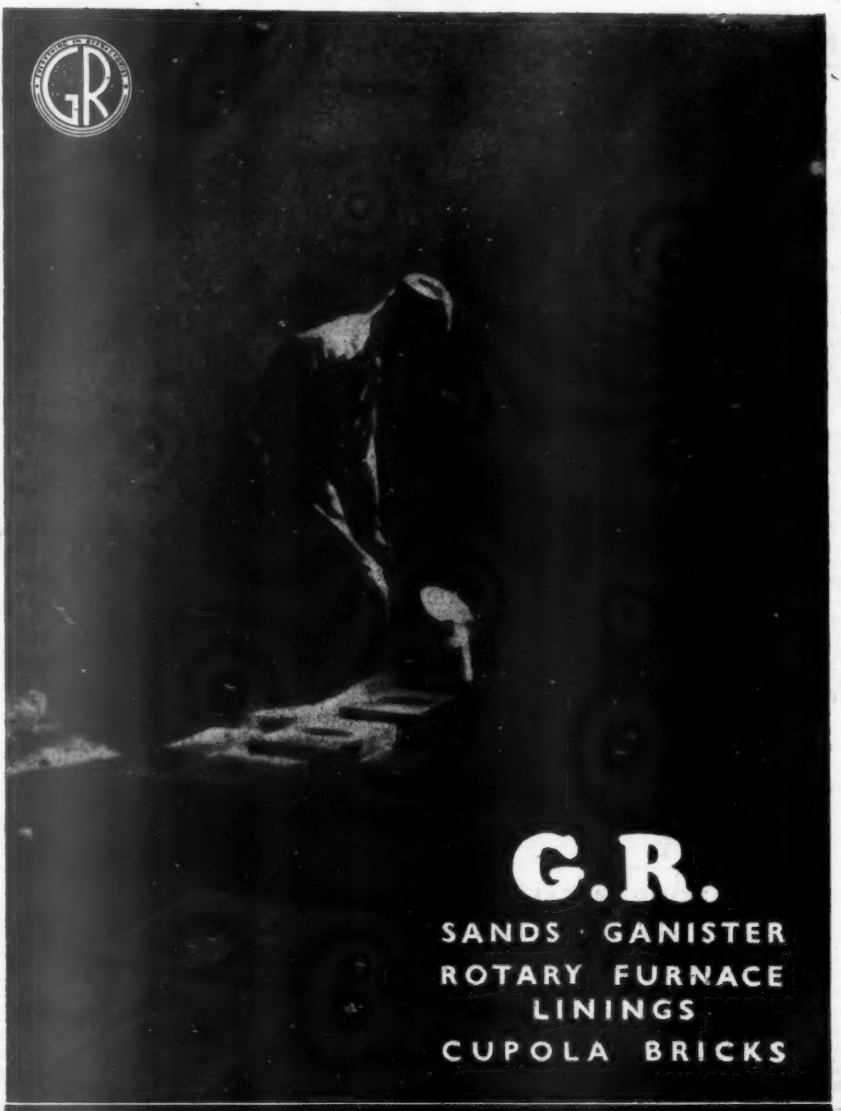
MAJOR C. TALBOT, a director of the South Durham Steel & Iron Company, Limited, Middlesbrough, has been temporarily released from the Army after more than four years' overseas service, and is now back at his duties with the company. Major Talbot is prospective Conservative candidate for Middlesbrough East.

MR. J. BLAKISTON, of Modern Foundries, Limited, subsidiary company of William Asquith, Limited, Halifax, machine-tool manufacturers, has been granted leave of absence to visit important Indian foundries on special duty. Mr. Blakiston is president of the West Riding Branch of the Institute of British Foundrymen.

MAJOR P. J. WILKINS, of the 2nd Battalion, the Essex Regiment, has been awarded the Military Cross for conspicuous gallantry. Major Wilkins was, until the outbreak of war, a representative of Fletcher, Russell & Company, Limited (Radiation, Limited) in the London area, and is the elder son of Mr. Percy Wilkins, the London manager of the same company.

AIR CHIEF MARSHAL SIR WILFRID FREEMAN will, at his own request, shortly be retiring from the post of Chief Executive of the Ministry of Aircraft Production, which he has held since 1942. He will be succeeded by Mr. E. N. Plowden, who is now Director-General of Engine and Materials Production. Sir John Buchanan, Assistant Chief Executive, becomes Special Adviser on Production from the same date.

COL. SIR W. CHARLES WRIGHT, LIEUT.-COL. J. B. NEILSON, SIR ANDREW AGNEW and SIR ROBERT BARLOW have been appointed directors of Richard Thomas & Baldwins, Limited. MR. T. F. DAVIES and MR. F. S. PADBURY have resigned from the board. MR. J. C. NEWMAN has resigned from the board of Baldwins (Holdings), Limited, and MR. E. H. LEVER, chairman of Richard Thomas & Baldwins, has been appointed a director. Col. Sir W. Charles Wright, Lieut.-Col. J. B. Neilson, Sir Andrew Agnew and Sir Robert Barlow were on the board of Baldwins, Limited. Mr. Davies joined the board of Richard Thomas & Company, Limited, in 1931, after many years as group manager with the company's East Wales tinplate works. His retirement has been brought forward by the merger between Richard Thomas and Baldwins. Mr. Padbury resumed executive activities on the outbreak of war and had consented to continue this assistance to the company during the period of hostilities. He will remain as deputy-chairman of the Grovesend Steel & Tinplate Company, Limited, and as a director of certain other subsidiaries.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Raw Material Markets

IRON AND STEEL

The dislocation of transport owing to the severe weather throughout the month of January has created difficulties in the delivery of supplies to the blast furnaces and foundries, but, on the whole, normal production had been maintained. Subject to occasional delays, licensed tonnages of pig-iron are coming through, and, although stocks are only of modest dimensions, there is no reason to apprehend a shortage. More active preparations for the erection of temporary houses has given an impetus to the light castings trade, but with few exceptions quiet conditions prevail in the heavy engineering and allied foundries.

Activity in the re-rolling industry is reflected in the steady pressure for small billets, blooms and sheet bars. British steelmakers are providing big tonnages, but use of foreign material has been stopped and, in consequence, there is a ready market for other classes of re-rolling material, such as defective billets and sheet bars, double-sawn crops, etc. A certain amount of shell discard steel is also available, but this is less easily cleared, as the presence of alloys makes it unsuitable for many purposes.

Far from there being any improvement in the volume of business placed with the rolling of heavy steel plates, joists and sections, the position appears to have undergone further deterioration. Most surprising in the light of the supposedly heavy calls on sea transport for the Pacific war, is the steady shrinkage in shipbuilders' specifications. This may only be a temporary phase, but, in the meantime, additional work for the plate mills is urgently needed. By way of contrast, the mills engaged on rails and colliery material are quite busy, while light sections and small bars are well specified. If interest in heavy sheets has declined, orders for light sheets can only be placed for delivery in the second period. The tube trade is only moderately active, but wire mills are working to capacity. Production of shell steel and shell bars is maintained at a high level.

NON-FERROUS METALS

A little more copper is being used for war purposes, but the increase is not great and, compared with the level of consumption even a year ago, the amount of metal flowing into the munitions factories and armament works is down considerably. There is no lack of outlets for copper-bearing articles among the civil population at home and in export markets, but not a great deal of metal is being absorbed in these directions yet. It is not so much the fact that the authorities are reluctant to release material as that labour and other factors narrow the opportunities of undertaking manufacture.

Progress in the Pacific war is encouraging, but it must be a long time before the output of the Malayan tin mines is available for consumption here and in America. Meanwhile, economy in use continues to be essential, and although the end of the war with Germany may remove control from a good many metals and material, careful distribution of tin would appear to be necessary so long as Europe and the U.S.A. are denied the use of the Far Eastern deposits.

There are no new developments in lead and zinc, which are in good supply for war purposes and are being released in reasonable quantities in other directions.

NEW COMPANIES

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

Ross Metallizing, 52-54, High Holborn, London, W.C.1—£1,000. H. R. and J. L. R. Dreher.

Wise & Greenwood, 51, Lincoln's Inn Fields, London, W.C.2—Workers of and dealers in metals. £10,000.

Beacon Machine Tools, Hurst Lane, Tipton, Staffs—Tool makers. £10,000. J. W. and W. R. Lait, and J. H. Lyndon.

A. J. Gould, Chiltern Works, Desborough Park Road, High Wycombe—Engineers, etc. £5,000. A. J. Gould and E. Smith.

Charles W. Bird, 10a, St. Mathews Road, Smethwick, 40—Engineers. £2,000. C. W. Bird, L. A. Bruton, and A. T. Bowater.

Porchester Engineering Company, 1-6, Porchester Street, Birmingham—£3,000. W. S. Cooper, F. Johnson, and E. C. Mabey.

Steel Products (Lincoln), Limited, Midland Bank Chambers, Guildhall Street, Lincoln—£500. A. Suthrell, J. Akrill, and R. F. Elmer.

A. J. Walker & Sons, 8-10, Ravenscourt Avenue, London, W.6—Engineers, tool makers, etc. £1,000. A. J., G. M., R. G., and A. R. Walker.

A. C. Morrison (Engineers), 10, New Street, Leicester—Manufacturers of and dealers in electrically-propelled vehicles, etc. £15,000. A. C. Morrison and J. Lilliman.

Telcon-Magnetic Cores—Manufacturers of cores for electric transformers. £20,000. Sir G. R. Clarke, 22, Old Broad Street, London, E.C.2, W. F. Randall, J. A. Holden, and A. A. Asplin.

MR. JAMES G. ARNOTT, for the past ten years foundry manager of the Clyde Alloy Steel Company, Limited, and well known in marine engineering circles, has joined G. & J. Weir, Limited, as general manager of the Holm Foundry, Cathcart, and Argus Foundry, Thornliebank, in succession to the late Mr. Norman McManus. Mr. Arnott has had considerable foundry experience in this country and in France and Switzerland. The engine room castings for the "Queen Elizabeth" and other famous ships were made at Clyde Alloy works under his supervision. In 1926 the Surtees Gold Medal was awarded by the Institute of British Foundrymen to Mr. Arnott, and from 1930 to 1934 he was lecturer in foundry work at the Glasgow Royal Technical College.